

than usual, and with few exceptions, were not susceptible to frost damage. No general frost warnings were issued and, as a rule, the local interests were protected by advance advices as far as practicable. This was especially the case in the cranberry marshes of Wisconsin, where abnormally low temperatures are the rule during frost conditions.

A disturbance of considerable intensity developed in the Northwest on the 18th, and moved in an easterly direction with its center over the northern Lakes, attended by strong shifting winds on the 20th. Storm warnings were ordered for western Lake Superior on the evening of the 19th and for the remainder of the Great Lakes on the morning of the 20th, apparently sufficiently in advance of the occurrence of the storm.

Rather strong winds also prevailed on the northern and central portions of the Great Lakes on the 30th, because of the development of a disturbance west of the Mississippi River and an area of high pressure of great magnitude which moved southeastward from the Canadian northwest over Ontario, these causing a steep barometric gradient over the Lakes.

There were no other storms of marked importance, so far as winds are concerned.

For the information of the pilots taking part in the First Annual Commercial Airplane Reliability Tour special forecasts were furnished to the aviators daily or twice daily from the time the planes left Detroit on September 28 until their arrival in Indianapolis October 2.

I was personally advised, moreover, by the flyers that the information was of great service to them; and a letter of appreciation was recently received from the aviation committee of the Chicago Association of Commerce.—*H. J. Cox.*

NEW ORLEANS FORECAST DISTRICT

A disturbance of moderate intensity appeared in the west Gulf off the mouth of the Rio Grande during the evening of the 6th, and northeast storm warnings were ordered displayed at 9 p. m. from Corpus Christi to Brownsville, and on the morning of the 7th were extended over the remainder of the Texas coast. The disturbance moved northward with diminishing intensity and storm winds occurred only on the western portion of the Texas coast. Small-craft warnings were displayed at Corpus Christi on the 17th, 24th, and 29th. No storm occurred without warning.—*I. M. Cline.*

DENVER FORECAST DISTRICT

Low pressures prevailed in the Rocky Mountain region during the first two decades, attended by frequent showers and thunderstorms in the Denver district. An area of high pressure, accompanied by much lower temperatures, with occasional frost in the northern portion of the district, drifted slowly across the northern Rocky Mountain sections during the period from the 19th to the 24th. High pressures and low temperatures also prevailed in western Canada and the northern portion of the Rocky Mountain region from the 26th to the end of the month, while a low of moderate intensity advanced eastward from the plateau from the 24th to the 29th. This last disturbance was followed on the 30th by frosts in western Colorado, Utah, and northern Arizona, with freezing temperatures in southern Utah, the southwestern valleys of Colorado, and at the higher elevations of northern Arizona.

Warnings of frosts and freezing temperature were issued as follows: 21st, frost southwestern Colorado and at the higher elevations of northwestern Colorado, northern Arizona, and southern Utah; 22d, frost northern

and western Colorado and at the higher elevations of northern Arizona and southern Utah; 23d, frost in northern and western Colorado and at the higher elevations of southern Utah; 24th, frost in southwestern Colorado; 29th, frost in northwestern Colorado, extreme northwestern New Mexico, and southern Utah, with freezing temperature in southwestern Colorado and at the higher elevations of southern Utah and frost or freezing temperature in north-central and northeastern New Mexico; 30th, frost in Colorado, northwestern and extreme north-central New Mexico, northeastern Arizona, and northern and eastern Utah, with freezing temperature in southwestern Colorado and at the higher elevations of northeastern Arizona and northern and eastern Utah. The warnings were generally verified.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT

The month opened with a well-defined area of high barometric pressure over the ocean, low barometric pressure over Alaska, and low barometric pressure over the continent west of the Rocky Mountains. This situation rapidly changed during the first two days of the month and on the second the HIGH over the ocean shifted northward and a disturbance formed some distance off the California coast. While the HIGH over the ocean moved northward and became centered over the Gulf of Alaska and the ocean to the southward, the pressure remained low along and off our coast. This area of low pressure persisted for several days and finally advanced eastward, crossed the coast line and the weather cleared throughout the Pacific States. In the meantime there were local showers in northern California and nearly all other sections west of the Rocky Mountains. The first rains of the season in northern California accompanied the changed pressure situation as described. The rains, coming early, did no material damage to fruit that was in the process of drying.

From the 8th to the 12th inclusive, the HIGH over the ocean was at all times well defined and of considerable extent, but centered far northwest of its normal position and with its major axis paralleling the meridians rather than the parallels of latitude, its former direction. This situation was attended by the formation of areas of low barometric pressure off our coast, one of which on the 16th assumed the characteristics of a disturbance of marked intensity off the Washington-Oregon coast, on which date at 8 a. m., one hundred and twentieth meridian time, a barometer reading of 29.20 inches was reported by the *S. S. Waitemata* while in approximately latitude 45 degrees north and 130 degrees longitude west. This disturbance instead of advancing eastward moved southward along the periphery of the HIGH to the westward and caused quite general rains in the north portion of northern California, the Pacific Northwestern States and the Plateau States during the succeeding several days. On the 16th storm warnings were ordered for coast stations at and north of Cape Mendocino, and while no storm winds occurred at coast stations, winds of gale force prevailed off the coast as shown by reports received by radio from ships. The rains in California were forecast sufficiently ahead of their occurrence to permit of protective measures being taken to prevent damage to drying fruit. The weather became again fair throughout the forecast district on the 20th, and remained so until the 25th, when conditions became unsettled along the north coast. In the meantime warnings of high fire hazard in the forested areas were issued on the 21st for southern California, where during the following several days the relative humidity was decidedly below normal.

On the morning of the 22d similar warnings were issued to forestry interests in the States of Washington and Oregon. These forecasts were minutely verified by the subsequently recorded temperature, humidity, and winds. After the 25th and until the end of the month the weather remained unsettled and showery in the northern half and fair in the southern half of the district, and at its close the temperature was low with frosts in the Plateau States.

Special weather forecasts for the information of driers of fruit were issued daily during the month and broadcast by radiophone. A specimen of this type of forecast, i. e., the one issued on the 30th, follows:

In the Santa Rosa, Napa, Sonoma, Santa Clara, Sacramento and San Joaquin Valleys the weather will remain fair during the next several days with moderate temperature and gentle changeable winds. Good drying weather is indicated.

—E. H. Bowie.

RIVERS AND FLOODS

By H. C. FRANKENFIELD

The rise in the lower Rio Grande in early August, on which report was deferred until this issue of the REVIEW, passed flood stage at only one Weather Bureau gaging station—San Benito, Tex. No reports of damage have been received.

Virtually coincident with the above, however, another rise of more importance was in progress in the vicinity of and below El Paso, Tex. Definite reports are similarly lacking for this flood, though revised estimates by newspapers place losses resulting from it at \$275,000—chiefly in crops and levee damage. The progress of the crest, which gradually diminished, was evident in moderate rises downstream later in August, but flood stage was not reached at any Weather Bureau station.

A third and much more serious rise occurred in the vicinity of El Paso early in September. Of this flood Mr. Robert M. Shaver, official in charge of the Weather Bureau office at El Paso, reports as follows:

The occurrence of heavy rains over the upper portion of the Rio Grande watershed between El Paso and the Elephant Butte Dam, which is 122 miles northwest of El Paso, on August 31 and September 1, 1925, caused a rapid rise in the river.

Limited overflows occurred at a few points in the valley northwest of El Paso on September 1 and 2; and serious overflows at several places from 6 miles northwest to 40 miles southeast of El Paso during September 2, 3, 4, and 5.

Engineers estimated that 11,500 acres of land were flooded on the American side of the river, and 5,000 acres on the Mexican side; and that 75 per cent of this land was under cultivation. Between 300 and 400 houses, built of adobe, a majority of which were in El Paso and its immediate vicinity, were ruined or seriously damaged when their walls were crumbled by coming in contact with the water. A greater number of houses suffered lesser injuries. The most conservative estimates placed the total loss occasioned by the flood at \$1,000,000.

The United States Reclamation Service, with project headquarters at El Paso and substations and river gages at certain points along the river, was able to follow the stages of the rise and issue adequate warnings.

There would have been far greater destruction had not dikes been prepared hastily at the weaker points along the river bank. This work was directed largely by the local officials of the United States Reclamation Service and the city engineer. The farmers and their helpers were assisted greatly in the construction of the dikes by soldiers and materials from Fort Bliss.

Since the completion of the Elephant Butte Dam in 1916, there has been a gradual rise in the bed of the river, due to the decrease in the rate of movement of the river. There is also a large horse-shoe bend in the river just below El Paso which also retards the movement. The increase in elevation of the river bed at the Santa Fe Street Bridge at El Paso is now 9 feet. This induces a dangerous condition, as comparatively small rises in the river will produce overflows.

Heavy rains in the lower portion of the watershed again raised the river to above flood stage at Rio Grande

City and San Benito on the 8th and 9th. Of the results of this rise, Mr. J. H. Jarboe, official in charge of the Weather Bureau office at San Antonio, Tex., reports in part as follows:

Levees, weakened by continuous rains during the month, gave way in several places and large sections of farm lands were flooded. Most crops had been harvested and the losses were mostly in delayed farm work, delayed business and transportation, and about \$40,000 spent in holding and repairing levees, mostly in Cameron County.

A destructive local flood, caused by heavy rainfall over the precipitous and narrow Squillchuck Canyon and resulting in the loss of 14 lives and property damage estimated at \$130,500, occurred near Wenatchee, Wash., during the afternoon of September 5. Since no rain gages are maintained in the area over which the heaviest rain fell, no data are available as to its amount; but the topography of the canyon is such that even a moderately heavy fall, if sudden enough, could readily have caused a flood of this extremely destructive type. The losses were apportioned as follows:

Railroad property.....	\$75,000
Highways.....	3,500
Irrigation canals and ditches.....	4,000
Fruit trees washed out.....	3,000
Buildings, automobiles, and other property.....	45,000
Total.....	130,500

The high stages occurring in the Gila and Hassayampa Rivers of Arizona were without consequence; and no report of damage has been received of the moderate flood in the Grand River of Missouri on the 13th and 14th.

Low water.—Moderate rainfall during the last decade of September in the Southern States brought to an end the drought which had continued in that section since June. In addition to the widespread unfavorable effect of this drought on crops, farmlands, forests, etc., rivers fell to extremely low stages, with the result that water power failed in many sections, street-car schedules were curtailed, mill operations reduced, navigation seriously impeded, and the consumption of electricity generally curtailed. Many communities, confronted with an acute shortage of water for direct use, were compelled to ration their supplies.

The river stages were the lowest of record in many sections, and a statistical summary relative thereto appears in the following table:

Principal rivers in which low-water records were established during August-September, 1925

River and station	Low-water stage (feet)	Date (1925)	Previous low-water record (feet)	Date
Peedee: Cheraw, S. C.....	-2.0	Sept. 13	0.0	Aug. 2, 1886
Santee: Rimini, S. C.....	0.2	Sept. 9	1.0	Nov. —, 1904
Oconee: Dublin, Ga.....	-2.4	Sept. 7	-1.8	Sept. 14, 1914
Ocmulgee:				
Hawkinsville, Ga.....	0.8	Sept. 11	1.3	Sept. 15, 1911
Abbeville, Ga.....	-1.7	Sept. 5	-1.0	June 17, 1898
Chattahoochee: Norcross, Ga.....	0.6	Aug. 25	1.0	Sept. 30, 1911
Flint:				
Woodbury, Ga.....	-0.9	Sept. 24	-0.5	Oct. 24, 1904
Albany, Ga.....	-3.2	Sept. 27	-1.4	July 31, 1921
Apalachicola:				
River Junction, Fla.....	-2.5	Sept. 24	-0.2	Nov. 30, 1922
Blountstown, Fla.....	1.6	Sept. 23	3.0	(¹)
Coosa:				
Mayos Bar, Ga.....	-2.8	Sept. 5	-0.6	Sept. 17, 1914
Wetumpka, Ala.....	-2.5	Aug. 24	-2.0	Aug. 25, 1924
Alabama: Montgomery, Ala.....	-4.0	Sept. 22	-3.4	Nov. 25, 1924
Pearl: Monticello, Miss.....	-0.5	Sept. 11	-0.3	Oct. 20, 1924
Miami:				
Dayton, Ohio.....	-0.1	Sept. 5	0.6	July 27, 1923
Hamilton, Ohio.....	-1.4	Sept. 10	-1.3	Oct. 26, 1924
Tennessee:				
Knoxville, Tenn.....	-1.9	Sept. 10	-1.5	Dec. 1, 1895
Guntersville, Ala.....	-0.5	Sept. 29	-0.4	Nov. 18, 1924
Florence, Ala.....	-2.9	Sept. 25	-1.0	Nov. 27, 1924
Riverton, Ala.....	4.7	Sept. 28	5.0	Oct. 24, 1904
Savannah, Tenn.....	-2.6	Sept. 8	0.0	(¹)
Johnsonville, Tenn.....	-1.9	Sept. 11	-0.9	Oct. 26, 1904
Arkansas:				
Tulsa, Okla.....	0.4	Sept. 5	1.0	July 16, 1910
Little Rock, Ark.....	-2.8	Sept. 10	-2.4	Aug. 13, 1918

¹ And subsequent dates.

² Estimated.

³ About.

⁴ Data unknown.